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10/586,283	11/06/2006	Kassem Ghorayeb	94.0052	3037

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EXAMINER	
ALHIJA, SAIF A	

ART UNIT	PAPER NUMBER
2128	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/586,283	GHORAYEB ET AL.	
	Examiner	Art Unit	
	SAIF ALHIJA	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 September 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 6-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 July 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-4 and 6-20 have been presented for examination.

Claim 5 has been cancelled.

Information Disclosure Statement

2. The information disclosure statement filed 13 January 2011 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered. Foreign references 1 thru 4 do not appear to have been submitted. Appropriate correction is still required.

Response to Arguments

3. Applicant's arguments filed 19 September 2011 have been fully considered but they are not persuasive.

PRIOR ART ARGUMENTS

i) In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). However in the interests of compact prosecution the Examiner has clarified his position which was stated in the previous office action.

ii) Applicants argue that the references do not disclose coupling multiple simulations with a distinct controller. The Examiner notes that H recites **"This paper introduces a third approach to the problem, which we call Reservoir Coupling. The individual simulation models are still run as separate processes, with minimal change to their data. But they are coupled to a master process which handles the global production and injection constraints and determines the flow rate targets to be applied to the individual reservoirs at each time step. Inter-process communication is handled by the PVM message passing system. This can spawn processes over a network of heterogeneous Unix computers, enabling the individual simulation models to be run in parallel on separate workstations."** The Examiner notes that this recitation in combination with the recitation of Scott. Page 4, Forming Matrix Coefficients, both black oil and compositional simulators renders obvious the controller aspect recited. Specifically the Scott reference recites the aspect of differing simulations in the

case of black oil or compositional reservoir components and this in turn with the aspect of a master process of H which handles disparate simulations of the reservoir in parallel computation renders the controller aspect recited obvious. Applicants reinforce this reasoning since they acknowledge that H recites the aspect of master and slave simulators where one controls the other yet argues that it is limited to only black oil simulators which is overcome by the inclusion of the Scott reference which denotes the use of the multiple types of simulators recited. Therefore the prior art rejection is **MAINTAINED.**

iii) Applicants argue that the references do not teach synchronization of time steps between different reservoir models being simulated in real time. Applicants have provided no explicit rebuttal to this assertion except to say that the synchronous communication of Scott and Briens differs from the synchronization of the claims. As stated in the previous office action B recites in Page 431, left column, first paragraph, whereby the staging technique of the reference recites a first iteration level which is processed "far enough" on the grid to begin the second processor iteration This section further recites the aspect of staging of tasks amongst multiple processors to avoid memory conflicts and processor out of order issues and further results in load balancing as per bottom left of page 432 which states that the SST system automatically keeps good load balancing among the processors. This is further seen in the Scott reference whereby the first full paragraph of Scott on page 3 recites synchronous messages being routed automatically by the system and further the use of multiple machines as argued above. Further the Examiner notes that the reference clearly recites the parallel computing with respect to time and Newton iterations as can be seen in page 5 right column third paragraph which recites **"Another application of parallel computations is in the forming of matrix coefficients for composition reservoir simulators. Fully implicit compositional fluid models are highly non-linear and are often solved through use of a Newton-Raphson method [10,17,18]. Phase equilibrium and fluid property calculations are repeatedly applied in the updating of matrix coefficients. Since these calculations are independent for every grid block, this is an ideal application for the divide and conquer method. Pipelining of the formation of matrix coefficients and matrix solution steps could also be performed."** The Examiner notes that the Scott reference is clear in its goal of utilizing parallel computing with synchronous and asynchronous messaging as per the claim language and further that it would have been obvious to utilize these features in parallel computing in order to describe a faster and increased quality method of simulation

of hydrocarbon reservoirs. This in combination with the recitations of H as per section ii above, W, and specifically B above which reads on the claims recited and therefore the prior art rejection is **MAINTAINED**.

PRIORITY

4. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). Priority date is 23 November 2002.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. **Claim(s) 1-4 and 6-20** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Haugen et al. "Simulation of Independent Reservoirs Coupled by Global Production and Injection Constraints", hereafter H** in view of **Briens et al. "Application of Sequential Staging of Tasks to Petroleum Reservoir Modeling", hereafter B** further in view of **Watts U.S. Patent No. 6108608, hereafter W** further in view of **Scott et al. "Application of Parallel (MIMD) Computers to Reservoir Simulation", hereafter Scott.**

Regarding Claim 1:

H discloses A computer executable method of coupling multiple independent reservoir and network simulators with a controller comprising:

initiating a first reservoir simulation on a first simulator for one or more physical parameters of a first reservoir, the first reservoir simulation using a first fluid model; **(H. "An oil or gas field may comprise a number of isolated reservoir units, each of which may have been studied separately with their own simulation models" as well as "The individual simulation models are still run as separate processes…")**

initiating a second reservoir simulation on a second simulator for the one or more physical parameters of a second reservoir, the second reservoir simulation using a second fluid model; **(H. "An oil or gas field may comprise a number of isolated reservoir units, each of which may have been studied separately with their own simulation models" as well as "The individual simulation models are still run as separate processes…")**

initiating a network simulation on a network simulator to model a network for coupling the first reservoir and the second reservoir to a surface facility; **(H. "If these reservoirs are to be linked to common surface facilities, they are effectively coupled by global production (and perhaps injection) constraints." And further "A simulation study is described which illustrates the application of Reservoir Coupling to three isolated reservoirs subject to global production and injection constraints." Whereby this coupling of simulations represents the network simulator.)**

varying the duration of the controller time steps in a response to a production rate or an injection rate of the first reservoir simulator or the second reservoir simulator; **(H. "But they are coupled to a master process which handles the global production and injection constraints … at each time step" as well as "The individual reservoirs may also have their own flow constraints which must be applied at a lower level, hence forming a hierarchy of production and injection constraints." Although not explicitly recited as a controller, see Section 3.ii above)**

H does not disclose however B discloses, excluding the first and second reservoir aspect which is recited in H above, applying the controller time steps via the open message passing interface to the advancement

through time of the first reservoir simulator the second reservoir simulator **(B. Page 431, left column, second to last paragraph, "synchronization of parallel events")**

selecting maximum synchronization intervals to limit controller time steps; **(B. Page 431, left column, first paragraph, whereby the staging technique of the reference recites a first iteration level which is processed "far enough" on the grid to begin the second processor iteration)**

defining network balancing times based on the controller time steps; **(B. Page 431, left column, first paragraph, whereby the stating technique of the reference recites a first iteration level which is processed "far enough" on the grid to begin the second processor iteration. This section further recites the aspect of staging of tasks amongst multiple processors to avoid memory conflicts and processor out of order issues and further results in load balancing as per bottom left of page 432 which states that the SST system automatically keeps good load balancing among the processors)**

initiating network balancing among the simulators at a corresponding point in each controller time step. **(B. Page 431, left column, first paragraph, the aspect of staging of tasks amongst multiple processors to avoid memory conflicts and processor out of order issues and further results in load balancing as per bottom left of page 432 which states that the SST system automatically keeps good load balancing among the processors. The Examiner notes that the load balancing of the reference happens concurrently while the process is running to prevent conflicts.)**

and the network simulator each controller time step enabling the first reservoir simulator the second reservoir simulator and the network simulator to each take an independent number of non-identical time steps to advance to the start of a next controller time step; **(B. Page 431, left column, first paragraph, the aspect of staging of tasks amongst multiple processors to avoid memory conflicts and processor out of order issues and further results in load balancing as per bottom left of page 432 which states that the SST system automatically keeps good load balancing among the processors. The Examiner notes that the load balancing of the reference happens concurrently while the process is running to prevent conflicts and the staging represents non-identical time steps by virtue of its dynamic approach.)**

B does not disclose translating via the open message passing interface each of first hydrocarbon fluid stream of the first reservoir simulator and a second hydrocarbon fluid stream of the second reservoir simulator to a common fluid model;

However W discloses, excluding the first and second reservoir aspect which is recited in H above, translating each of a plurality of hydrocarbon fluid streams to a common fluid model **(W. Abstract)**

H, B, and W do not explicitly recite however Scott recites providing an open message-passing interface that communicates with black oil model reservoir simulators, compositional model reservoir simulators, and different types of surface network simulators; **(Scott. Figure 3, message passing)**

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the pseudocomponent aspect of multi component fluid flow as discussed in W for the multiple independent reservoir simulation of H as well as the synchronization and production operation in parallel simulation of B since first the pseudocomponent aspect of W is "particularly useful in estimating properties and/or behavior of fluids contained in hydrocarbon-bearing, subterranean formations or in hydrocarbon processing facilities." (W. Column 1, Lines 13-16) and further the synchronization and production operations of B through parallel processing result in a substantial decrease in processing time as well as promoting good load balancing for the simulation. (B. Page 432, Conclusions) It would further have been obvious to utilize the message passing and synchronization aspects of Scott with the simulation of H, B, and W since Scott describes a faster and increased quality method of simulation utilizing parallel computing, (Scott Introduction, Paragraph 1)

Regarding Claim 2:

See rejection of claim 1.

With respect to means for running the first reservoir simulation, the second reservoir simulation, and the network simulation as slave processes of the controller see Section 3.ii above.

Regarding Claim 3:

The reference discloses The controller of claim 2 additionally comprising means for balancing the coupled multiplatform reservoir simulators including means for apportioning global production and injection rates between simulation tasks of the first reservoir simulation and the second reservoir simulation. **(B. Page 428, top right, production/injection) (H. "But they are coupled to a master process which handles the global production and injection constraints...")**

Regarding Claim 4:

The reference discloses The controller of claim 3 additionally comprising means for balancing the coupled reservoir simulation and the surface network including means for balancing the surface network with the global production and injection rates apportioned between the simulation tasks of the first reservoir simulation and the second reservoir simulation. **(B. Introduction, paragraph 2, flow/material balancing. Page 432, left column, last two paragraphs, load balancing)**

Regarding Claim 6:

The reference discloses The controller of claim 2, wherein the means for initiating the first reservoir simulation initiates a first reservoir simulation that comprises a black oil model and the means for initiating the second reservoir simulation initiates a second reservoir simulation that comprises a compositional model. **(Scott. Page 4, Forming Matrix Coefficients, both black oil and compositional simulators)**

Regarding Claim 7:

The reference discloses The controller of claim 2, further comprising means for coupling additional reservoir simulations in addition to the first reservoir simulation and the second reservoir simulation, wherein the additional reservoir simulations run a mixture of black oil models with different sets of active phases and compositional models with different sets of pseudo-components. **(Phases can be seen in Scott, Abstract, multiphase case using black oil and compositional fluid models and the pseudo component aspect is taught in W and cited above)**

Regarding Claim 8:

The reference discloses The controller of claim 2, wherein the first reservoir simulation and the second reservoir simulation and the network simulation run on different computing platforms as slave tasks to the controller. **(Scott, Abstract, Parallel computers)**

Regarding Claims 9-13:

See rejection of claims 3-4, and 6-8.

Regarding Claims 14-20:

See rejection of claims 1-4, and 6-8.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. All Claims are rejected.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAIF ALHIJA whose telephone number is (571)272-8635. The examiner can normally be reached on M-F, 11:00-7:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571) 272-2279. The fax phone number for the organization where this application or proceeding

is assigned is (571) 273-8300. *Informal or draft communication, please label PROPOSED or DRAFT*, can be additionally sent to the Examiners fax phone number, (571) 273-8635.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SAA

/Saif A Alhija/
Examiner, Art Unit 2128

January 26, 2012